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Designing the Knowledge Management System (A Case Study Approach in IT Consultant Company)

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ABSTRACT

The goal of this research is to identify, analyze and design an effective knowledge management system for XYZ company in Indonesia. As the growing of consultant company in Indonesia, XYZ company need to keep the valuable knowledge, so they can use it in the future. The analyze and design method used by this paper are: Wiig Knowledge Management Cycle, Nonaka and Takeuchi SECI Model, and object-oriented analysis and design. And for the data collection, the authors did the interview with the enterprise solution manager and observation in the company to capture company daily activities. The results are the knowledge management system implemented to capture, manage and use the company knowledge work more effective. We can conclude that the knowledge management system can help the company to maintain their knowledge.

CCS Concepts

• Information systems → Enterprise applications

Keywords

Knowledge Management; Information System; Design; Analysis

1. INTRODUCTION

In the era of globalization, knowledge creation and knowledge management become dominant factors for organizations' global competitiveness [1]. The company need to maintain the global competitiveness, so the learning culture in the company need to have the ability to create, capture, transfer and modify their culture, knowledge and experience that they have. But before that, the company must be able to identify the knowledge they have. The factors that contributes to the failure of company to identify their knowledge is lack of awareness in the company. We can see the fact, since the employee do their job and considering it as normal thing to do and every body can do it. Then when somebody ask to employee regarding their experience or 'How to do that?', the employee tend to give the common answer and can not give specific explanation to the job description that he did.

During recent years, a lot of companies already had weak awareness about the Knowledge Management (KM). According to

AMR Research in Knowledge Management and Organizational Performance: A Decoded View journal by Mills, Annette M; Smith, Trevor A [2], US firms would have invested \$73 billion on knowledge management software in 2007, increasing by almost 16 percent in 2008. And Forrester Research Inc. (2010) reports that 20 percent of small and medium-businesses in North America and Europe plan to implement CRM or information and knowledge management tools in 2010 or later, representing the fastest growing software segment among small and medium-businesses. This data shows that the company in recent years aware about the knowledge in the company. KM is the important thing for the company to solve the current problems and create the innovation [3,4]. KM is the set of process that can help the company to support KM cycle activities [5]. And knowledge management will create a business value [6].

In order to collect all the knowledge, knowledge needs to be built. According to Wiig on Knowledge Management in Theory and Practice book by Kimiz Dalkir [7], the knowledge needs to be gathered from the personal experience, formal education and training. And it also from intelligence sources media, books, and peers. Then the knowledge needs to be hold, held by the people of the company, became their culture and in tangible forms, like books. Then after knowledge is held then we need to pool the knowledge. Make the knowledge accessible in one place, so the people can access it. The company have to create pool the knowledge of each employee. [8]. The transformation of knowledge in organization will help the organization to create the innovation [9]. And KM will help the organization to create competitive advantages [10,11].

According to Mahmoud, Mahmoud, & Ibrahim [12], explicit knowledge which is the documented and codified knowledge and in this kind of knowledge information technology, it will play as an important role to share and save this knowledge by using the systems and the latest technology in the organization. And tacit knowledge, which is the knowledge that come by experience in work, intuition and maybe we do not know that we have it or how to explain it, this kind of knowledge can be shared by the interaction and the good communication environment between employees in the organization.

The XYZ company, is the growing consultant company in Indonesia, which is also the representative of IT company in Indonesia. This IT company provides their clients with tools to manage their infrastructure and facility management. Such as, schedule for maintenance, schedule to replacing items, and so on. The company have the problem regarding knowledge transfer. In order a person to master in ABC application (this is the product from XYZ company) and customizing it for the clients of the

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ABC system, the employee needs to spend around 6 months to be the master of the application. That's not include learning the basic of Java Programming language. If the person doesn't have experience in Java programming language, he will spend another 6 months to learn Java basics. The company didn't have the solution to manage the knowledge, because all the training to be done by the instructor and mostly undocumented. Because of that, the authors need to create Knowledge Management System to solves the company problem regarding the Knowledge Management of the company. The objectives of the research are as follows: (1) Identifying the problems regarding the knowledge delivery on XYZ company; (2) Giving the suggestion of system that helps managing the knowledge on XYZ company.

2. METHODS

The methods used to analyze and design the knowledge management system for XYZ company are: (1) Data Collection Method: by Literature Study (This study is done by searching the information and theories from Books and Journals that related to Knowledge Management study) and Field Study (This study is done by direct observation, doing interview with XYZ company); (2) Analyzing Method: Wiig KM Cycle, Object Oriented Approach, The Nonaka and Takeuchi Knowledge Spiral Model (SECI Model). The process started with studying the literature from various sources of books and journals. Then, doing the observation to capture the knowledge activity of the company. After doing the observation, the authors did the interview with the stakeholders of the system, which means the person that is going to use the system. From all the results, the authors made the analysis of what kind of system that suitable for the company, then giving the company the suggestions or solutions.

3. RESULTS AND DISCUSSION

According to Rainer Jr., Prince, & Cegielski [13], the Knowledge Management Systems are refers to the use of information technologies to systemize, enhance and expedite the intrafirm and interfirm knowledge which can be used by the company to solving the current problem (high turnover rates). According to the observation conducted on mid-year 2016 until 2017, here are the results found from the observation:

1. The author finds that the knowledge data in this company are mostly unmanaged. During training session, the Enterprise Solution Manager, which has the responsibility to give the training to trainees, have to rely on his expertise, outdated manuals and training modules in the .PDF file, and his personal notes.
2. During the training session, the trainees require to take note on everything they have learn. But no one wants to share their written notes to everybody.
3. During the development stage, when the programmer gets stuck, the Enterprise Solution Manager tells them to refer to the help file. The help file is confusing to read.
4. The authors also discover that one person can filled multiple position in the organization structure. For example, the Enterprise Solution Manager also become the programmer and analyst too, doing the coding, analysis and design.
5. The enterprise solution manager is not always at the office all the time (in the client office), so it's going to be difficult for programmer to asking for assistance.

3.1 Company Current Business Process

The Director will analyze the potential client for the ABC application. Then he will contact one of the contact persons from the client. After the company agree to meet the Director, then the

Director will come and conduct a presentation or meeting to promote the ABC system. After conducting the presentation, the Director will ask if that future client is agreed to share some of its company information such as, information regarding their asset, how they use that assets, how they record this and is it required to have some special treatments or maintenance, and so on. After meeting with client, the Director gathered the meeting with staff to discuss what they will do next. During that time, enterprise solution manager makes the initial analysis of the company requirements and the business process. Then he will give direction to the database analyst to make analysis of the client database requirement, and system analyst will do the analysis of the client system requirement and programmer will do the customization.

Next, After the customization process done, the Programmer will test the application. If there is no error, it's means all the customer requirements are fulfilled, then enterprise solution manager will arrange a meeting again with the director to present what already done and what we need to do next. In the meantime, the Director will arrange a meeting again with the client to present the demonstration. Then, the Director will bring the enterprise solution manager to present the demo with the client. And during this time, the Director will negotiate the price of the application and discuss about the implementation plan. If client agreed, the development team, which consists of enterprise solution manager, Database Analyst, System Analyst and the Programmer will start doing the customization or development of the application until the implementation.

3.2 Problems During Operations of the Company

The Problem during the operation of the company is there is a high turnover in the XYZ company. And every time the employee leaves the company, they will bring all the knowledge (notes/documentation) with them. Notes are considered as information, since it has a meaning and value to the programmer or everybody that reads it [13]. Notes can consist of the list of bugs of the application, how to custom, how to use and any kind of information that is required for customizing the ABC Application. If they not leave the notes, that will be a problem because the company lost the valuable knowledge. If they leave the notes, that also a problem. Because they make notes in a book, the notes can't be capture and manage to become knowledge.

If the programmer didn't make notes, then they have to refer to the help file, that is included in ABC Application. There are two help files, one for user and one for developer. But the help file is complicated, that sometimes is not helpful. The employee can't also search for help regarding ABC application on google. There are no chat rooms, forums or other help sources that discuss about the ABC system. Knowledge culture in XYZ company are also become the problem. The Employees are reluctant to share information and knowledge each other. If they want to use this knowledge management tools effectively, they must change the knowledge culture, to little bit more open (open minded).

3.3 Current Tacit and Explicit Analysis

This are the current tacit and explicit for programmer and enterprise solution manager (see table 1).

Table 1. Tacit and Explicit Table Analysis of XYZ Company

| Tacit | Explicit |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> • Training session for the new programmer, from the enterprise solution manager with source from his personal notes, documents and everything that he keeps in hand. • Periodic Meeting with the Director for project progress discussion. • Discussion during the development process among the programmer, system analyst, database analyst and programmer. | <ul style="list-style-type: none"> • Minutes of Meeting During Training (.DOCX file stored in one of computer, unshared) • User and Development Training Modules or Manuals from ABC application such as the Java and HTML basic. (.PDF file stored in one of computer, unshared) • Compiled and summarized training modules from the instructor. (Either .DOCX or .PDF file stored in one of computer, unshared) |

3.4 SECI Model Analysis

This are the current SECI Model Analysis (see table 2):

Table 2. SECI Model Table Analysis of XYZ Company

| Socialization | Externalization |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> • Periodic Meeting with Director • Experience Sharing among the programmer, database analyst, system analyst and enterprise solution manager | Minutes of Meeting during the Training Session |
| Internalization | Combination |
| Training session for the new Employees with the help of training modules from the ABC application. | <ul style="list-style-type: none"> • Training Modules or Manuals from ABC application. • Compiled and Summarize training modules by the instructor |

3.5 Wiig Knowledge Management Cycle Analysis

The brief description of the Wiig KM Cycle as follows:

- **Build Knowledge: Experience sharing among programmer, learn during training session with instructor.**
The company can build the knowledge during the experience sharing. Experience sharing can be conducted during training or while handling the project or creating the demo. Since everybody, share his own experience and getting the responses and feedback, this can be the good opportunity for building the knowledge among programmer.
- **Hold Knowledge: Training Modules and Manuals**
Based on experience sharing conducted among the programmers, the training modules and manuals created. Some compiled by the ABC application, while others compiled by Enterprise Solution Manager.
- **Pool Knowledge: Stored in Personal Notes**
After experiencing with the application, the programmer might compile his own notes, in his personal notebook. Reading through manual book, training module or help menu could be confusing. In order to learn quickly, the programmer

makes his own notes that is stored in their personal notebook or in computer.

- **Use Knowledge: Knowledge used during the customization and development stage**

The programmer then use all of his combined knowledge to solve their problem faced with ABC application during the customizing demo stage or developing project stage.

3.6 Knowledge Taxonomy

This are the Knowledge Taxonomy Diagram of Knowledge Management in XYZ company (See figure 1).



Figure 1. Knowledge Taxonomy Diagram of XYZ Company

According to the knowledge taxonomy diagram XYZ company, they have two separate guides available to user one is the user guide for using the application and the other is development guide which is consists of the guide to customize the application. The specific content of each, describe as follows:

The example of User Guide:

- **How to Use (ABC application Basic):** This consists of the basic of ABC system, how to login and basic knowledge about the ABC system.
- **Asset Management:** This consists of how to use the Asset Management module. Including, how to register company asset.

The example of Development Guide:

- **Installation Guide:** This consists of how to install the software and explain about its file system.
- **SQL Server Basic:** This consists of the database structure.

3.7 Strategies of Acquiring IT Applications

According to Rainer & Cegielski [13], there are several methods in Acquiring IT Applications. In this case, the authors using open source software, it is more suitable for the company, since the company has only small number of employee and resources.

3.8 Requirements for the Application According to the Company Current Condition

According to this analysis, the company needs an application that:

- **Generic Requirements**
 - The Application must be free, no license fee, not trial and open source. If it is the application license fee, so it's mean

at least they have the slim down version, free edition or community edition that is free.

- 6 The Application must be able to be access from the computer within the company's computer network. The application could be desktop based or web-based application. If it is web based it means that the application must be able to be installed on company server. If it is desktop based it means that must be installed in both client and server.

- 6 The Application must not require the heavy customization, so it can be use right away.

- 6 T 6 Application must have the user friendly of UI.

- 6 The Application must be able to run on any platforms and web browser, specifically run under this company computer specifications.

- Knowledge Management Requirement

- 6 The Application must allow the enterprise solution manager to upload their content and the other programmer can see it. The application must have feature that only the uploader which is the enterprise solution manager can modify the content and the programmer can only read the content.

- 6 The Application must allow the enterprise solution manager to take control and ownership regarding the content that they publish. It means, only the uploader can modify the content, while the other can only view the content.

- 6 The Application must allow the programmer to easily find and search for any documents that is required.

3.9 Open Source Knowledge Management Applications

We did comparison for several open source knowledge management applications against company requirements, e.g. Open KM, Alfresco, and XWiki. And based on the analysis that we did, we made decision to implement Alfresco system for XYZ company. This are the comparison table between several open source knowledge management applications against company requirements (see table 3 and 4).

Table 3. Comparison Table Among Open Source Knowledge Management Application Against the Company Requirement

| Company Requirements | OpenKM | Alfresco | XWiki |
|---------------------------------------------|---------------------------------|----------------------------------------|-------------------------------------------------|
| Generic Requirement | | | |
| Free of License | Yes, also have the paid version | Yes, also have the paid version | Yes |
| Open Source | Yes | Yes | Yes |
| Can be Accessed through the Computer | Yes, Web Based | Yes, Web Based | Yes, Web Based |
| Not require heavy customization | Yes | Yes | No. Require Heavy Customization |
| UI are user friendly not confusing | No. Too many unused functions | Yes | Yes |
| Can run on any platform and web browser | Yes | Yes | Yes |
| Minimum Specifications for Each Application | Java Development Kit 1.6 | 64 Bit Based systems CPU with clock | Java 8 Servlet Container supporting servlet. |

| | | | |
|--------------------------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------------|-----------------------------------------------------------------|
| | 2GB RAM SATA HDD Dual Core Intel CPU 3.20 GHz | speed at least 2.50 GHz SCSI RAID Drive Recommended | JDBC 4 Driver |
| Knowledge Management Requirements | | | |
| Allow the uploader to upload their knowledge content | Yes | Yes | No. Require heavy customization since there is no such feature. |
| Allow the uploader to take control and ownership of the content | Yes | Yes | No. Require heavy customization since there is no such feature. |
| Allow the programmer to search the manual and training modules they need | Yes | Yes | Yes |

Table 4. Comparison Table between Alfresco Server Requirements with the Company Current Server Configuration

| Alfresco Server Requirements | Company Current Server Configuration |
|----------------------------------------|--------------------------------------|
| 64 Bit Based systems | 64 Bit Based System |
| CPU with clock speed at least 2.50 GHz | Intel Xeon CPU 3.0 GHz |
| SCSI RAID Drive Recommended | HDD not configured with SCSI RAID |

As we can observe by this table that the current configuration of the company's server is already adequate for the Alfresco application. Even though the server does not configure with SCSI RAID but since it only just the recommendation and the application can still run without it, the company may or may not invest more on the SCSI RAID drives. There are three actors in this system:

1. **Administrator.** The role of administrator in this application is to create a new user account for the new employees in order to grant user access to the application and delete the user account from the knowledge management system in case the employee leaves. His role here is to make a backup of any knowledge data (in case that the knowledge data get removed).
2. **Programmer.** The role of programmer in this application are to use the knowledge management application to download and read the resources. Programmer can't upload or modify the content, but only enterprise solution manager can modify.
3. **Enterprise solution manager.** The role of enterprise solution manager in this application are to manage the account of his programmer and the content of the knowledge management. The enterprise solution manager can upload the knowledge management content. And only the senior can upload content as the company requirements. The enterprise solution manager can also add or remove programmer from the application list, so they can register the new programmer to be able to access the system and also can deregister the programmer that already resign to not be able to access the application.

3.10 Network Diagram

The suggested network is combined network between wired and wireless technology since the company have both. Some computers will be connected to the switch, while some others connected using wireless network, through the router or access point that is connected to the switch. The diagram that shown both connectivity in one diagram are as follows (see figure 2):

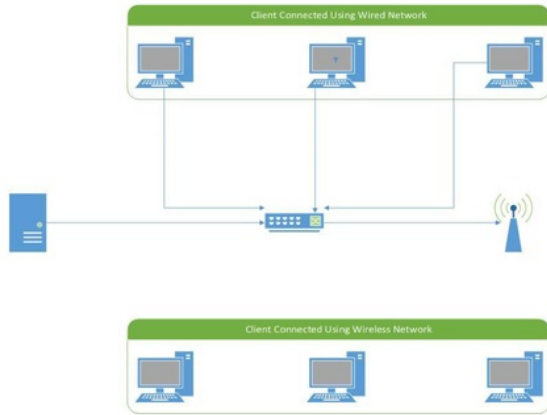


Figure 2. Proposed Network Diagram

4. CONCLUSION

The problem in this company can be solved by using the knowledge management system. The system will ensure that the company can build, hold, pool and use the knowledge altogether, this research results can conclude that:

1. The problem of the company is not being able to manage their knowledge that already identified. It is started with the very minimal resources from ABC system by providing help file only, the programmer can make a personal note, that aren't manage by ABC system and it doesn't open to everybody. And the closed knowledge culture has become the problem in the company.
2. By the implementation of the knowledge management application, the company can better solve the problem regarding knowledge management in the company. The application can surely help the programmer to make his job done. The programmer has the tools by just opening the knowledge management application and look for whatever knowledge that he wants to look for.
3. The growing company must have knowledge management application, considering that the knowledge is unmanaged and unshared, as this research discovered in XYZ Company.

We suggest for the future research topic about the effectiveness of knowledge management system implementation in the company (evaluation). Also, the next research will discuss about the security aspect of this application.

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